With the author's compliments.

ON THE

TREATMENT OF ARTHRITIC DEFORMITIES.

Being the Introduction to a Discussion in the Section of Surgery at the Annual Meeting of the British Medical Association, Aberdeen, July, 1914.

BY

ROBERT JONES, CH.M., F.R.C.S.E.,
F.R.C.S.I.(HON.),
LECTURER ON ORTHOPAEDIC SURGERY, UNIVERSITY OF LIVERPOOL.

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ON THE TREATMENT OF ARTHRITIC DEFORMITIES.

MANY cases of arthritis hitherto classified as tuberculous belong really to other groups, but although these present manifold and often easily diagnosed variations in their clinical course, they nearly all present similar deformities. In some these deformities appear early, in others they appear late, but whenever and wherever they appear they reflect discredit upon somebody—the parent for not seeking advice, or the practitioner for failing to appreciate the fundamental principles of treatment.

The prevention of deformity is therefore a much more important matter than its correction, but except indirectly this phase of the subject will not be discussed. Certain symptoms are common to every variety of arthritis, but the essential symptom is that of limitation of movement of the joint in each of its normal directions. It is difficult to prevent deformity unless we know the types which occur in the natural course of disease. In arthritis of the big toe we must expect plantar flexion; of the ankle, extension; of the knee, flexion, accompanied in the more pronounced cases by rotation outwards and displacement backwards of the tibia; in the later stages of arthritis of the hip, flexion, adduction, and internal rotation; in that of the wrist, palmar flexion; in the elbow, extension to about 110 degrees, and in arthritis of the shoulder, adduction. In cervical caries the malposition of the head depends upon the location of the disease. If the upper two or three vertebrae are diseased the head is twisted to one side into the position of wry-neck. If the disease be lower the chin is advanced and dropped towards the chest. If the disease is yet lower the chin is elevated and somewhat advanced, the head being thrown backwards towards the shoulders, which are raised to meet it. In view of the possibility of ankylosis the surgeon should ascertain from the patient what position he would desire his joint, in order to obtain most use from it. In the case of the elbow this will depend largely upon occupation, and to a lesser extent also in the

case of the hip. The hip is usually best fixed fully extended, as is also the knee; if bony ankylosis should occur a little flexion at both joints is no disadvantage. The ankle should be fixed at right angles, and the elbow slightly below the right angle. The wrist should be kept hyperextended.

Fig. 1.—Abduction frame applied for right tuberculous hip.

I need say no more in regard to preventive measures. When we realize the deformity of the untreated case we can always be prepared for its prevention.

To simplify the subject take first tuberculous deformities in the young. At the outset it may be asked, "At what stage of the disease should we correct deformity? Should we alter the malposition of a joint in the stage of its activity, or wait until recovery has taken place?" It is perfectly safe to correct deformity during the active period, and comparatively simple. My experience does not favour the view that by this act a general dissemination of tubercle will be caused.

In the hip-joint, therefore, when a case presents flexion, adduction and elevation of the pelvis, I apply a frame so constructed as to govern the triple deformity (Fig. 1). The splint should never be fitted to the deformity, but the deformity should be moulded to the splint. The limb is then retained rigidly at rest both to recover from the manipulation and in obedience to the principles according to which we treat such joints. It is obvious that the manipulation should be practised without excessive force, slowly and gently, never rapidly or roughly.

In the case of the knee, flexion and tibial displacement are corrected together, and the limb placed in a Thomas's bed knee splint. The correction is not necessarily completed at the one sitting. The deformity may be only partially reduced and then the treatment be completed by extension in the splint.

Palmar flexion at the wrist should be changed to dorsiflexion, in order that a good grip should be secured if ankylosis should become permanent (Fig. 1A). The power of grasp, as we know, diminishes in proportion to the amount

of flexion, at the wrist. The shoulder should be kept abducted, held somewhat forwards, and slightly rotated inwards, so that if ankylosis occur the range of movement will be materially assisted by the muscles of the scapula. Deformities of the spine may always be diminished by appropriate padding while the patient lies upon a convex frame.

These deformities, obviously fibrous in character, are thus corrected during the presence of active disease, and this correction is maintained until the joints recover. Such methods, however, are of avail only when the deformities are fibrous. If bony fixation has occurred, more radical measures are needed. Bony ankylosis in children is a comparatively uncommon ending, so that osteotomies, removal of wedges of bone, and similar radical measures are very rarely called for in the very young.

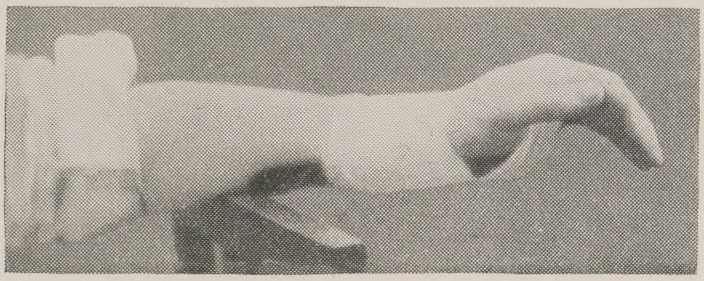

Fig. 1A.—Showing wrist held in dorsiflexion by "cock-up" splint.

A fibrous ankylosis has one serious clinical drawback—it goes on contracting and adding to deformity for a considerable time, until at last it becomes quiescent. H. O. Thomas introduced a nomenclature of ankylosis which was of considerable clinical value. He spoke of sound and unsound ankylosis. The distinction is that in unsound ankylosis the angle of flexion will be increased by use, and that in sound ankylosis the angle will not be altered by use. This is a useful classification, more especially when we deal with the adduction deformity in arthritic affections of the hip.

In those cases of hip disease in patients more advanced in age with typical deformity, where the disease has nearly run its course, we have to consider whether it may not be wiser to perform an osteotomy below the affected area in order to correct the flexion, pelvic obliquity, and internal rotation of the limb. This is often a time-saving measure, as we avoid the renewed deforming effects which would result from an attack upon an unsound ankylosis. I will endeavour to make this more clear. In a small child where disease is active and the diseased structures are soft, by placing a hip in abduction with extension we allow it to run its course until the ankylosis is sound, until, in fact, the angle at the joint will not be altered by use. In the more advanced case, where the deformity has been allowed to take place and the patient has nearly

recovered, one might perform a subtrochanteric osteotomy and place the limb in abduction, rather than force the joint into abduction with the knowledge that the deformity would partially recur. A sound fibrous ankylosis at the hip, therefore, is best left alone, and the operative attack should be made below the joint.

Tuberculosis in the young I have always looked upon as benign and tractable; in the adult it is a very different disease, requiring early and radical attack. The deformities presented are similar in both.

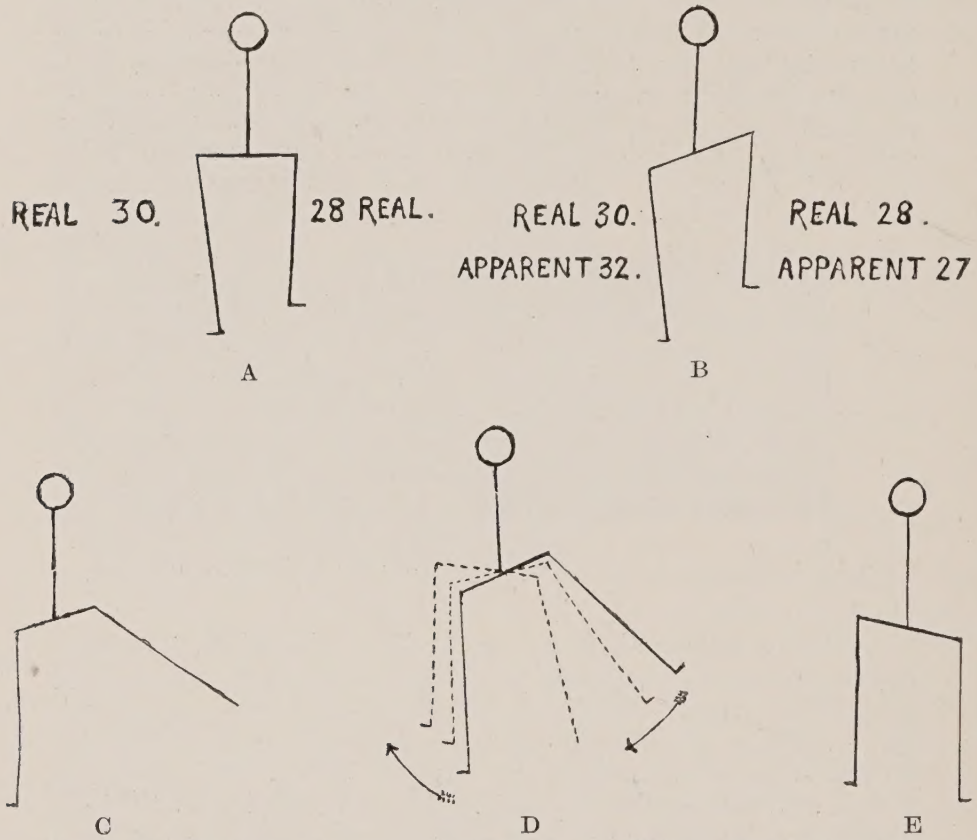

Fig. 2.—A, Showing 2 in. real shortening. B, Tilting of pelvis; showing real and practical shortening from pelvic obliquity. C, Position of leg after trans-trochanteric osteotomy. D, Showing elevation of pelvis on sound side by bringing abducted leg into position. E, Showing final result with adduction of leg and elevation of pelvis of sound side.

For the correction of deformity in the short fibrous and in the osseous types, the possible procedures consist of manipulation with or without extension, osteotomies, wedge exsections, exsections of joints, pseudo-arthroses, and arthroplasties and transplantations.

Manipulation with extension should always be our method of attack, in young children, where the disease is active, and in patients, of whatever age, where the fixation is soft and fibrous, and where operation is disallowed. It should never be advocated in the adolescent. where the ankylosis is sound, be it fibrous or bony. Osteotomy is employed with best effect on the femur to correct deformities at the hip, and sometimes to correct faulty lateral alinement in connexion with arthritisof the knee. Where

ankylosis is bony the operation is most successful, and I have often, in the case ot pelvic obliquity, corrected four and five inches of practical shortening (Fig. 2). If the adduction and flexion are marked and the neck of the femur is not absorbed and the ankylosis is bony, I prefer a trans-trochanteric section. To do this safely, no matter how pronounced the flexion and adduction, it is advisable to make the section through the bone parallel to Poupart's ligament, and the operation should be completed by subcutaneous division of the adductors.

If the neck and head of the femur be absorbed and the trochanter raised, it will be necessary to remove a wedge from the base of the trochanter, as a simple osteotomy will not secure sufficient abduction. A subtrochanteric division should never be done if the flexion is acute, otherwise when the limb is straightened the upper end of the femur will project in Scarpa's triangle.

The subtrochanteric division should be reserved for cases of unsound fibrous ankylosis where flexion is not so marked a feature as adduction and rotation. In the adult this section is sometimes made by open incision, as the bone is very apt to splinter, and, if a wedge be removed with its base to the outside, the severed ends will remain in excellent apposition. Although the Gant operation done subcutaneously can scarcely be defended upon artistic or mechanical grounds, I have never yet met with a failure of union. The trans-trochanteric route should be that selected where the essential condition renders it possible. After the osteotomy the limb should be kept for six weeks well abducted, and at the end of that period the leg is brought to the middle line, the pelvis follows it, and in this way the practical length of the short limb is increased, the amount of lengthening being proportionate to the abduction at which it was placed.

In bony ankylosis of the knee a wedge is removed anteriorly, the shape of the wedge depending upon the degree of flexion and the presence or absence of lateral deviation. The fit should be very accurate to ensure a firm ankylosis.

In performing this operation it is better not to allow the apex of the wedge to reach the popliteal space; it should end half an inch anteriorly. The wedge of bone is then removed and the remaining bone is cautiously divided by means of the saw. The knee is then completely flexed, the posterior sharp ends trimmed, and the limb extended. In this way the vein and artery are secure from danger.

In cases where moderate flexion persists with otherwise free movement, an oblique osteotomy should be performed, and the limb straightened. In this way the joint mobility is transferred to a more useful sphere of activity.

In bony ankylosis of the shoulder, more particularly in young children, an osteotomy of the neck of the humerus may be advantageously employed in the young. The arm is rotated inwards and abducted forwards, and when union has taken place the arm can be lifted high.

Within comparatively recent years there has been a

growing dissatisfaction felt towards the ankylosed joint, and in fields wide apart experiments and operations have been performed with a view of mobilizing ankylosed joints. Most of us who have dealt largely with colonies of tuberculous children have preferred a firm ankylosis as an end-result to the restricted movement which sometimes occurs. There is apt to be recurrence where movement remains, and through the years, if a true recurrence does not take place, there are frequent alarms, the consequence of strain. These recurrences are more likely to take place in tuberculous joints than in those of septic origin.

But to obtain movement in joints without adding to the risks of recurrence of disease has been a very fascinating study and achievement during the last few years. We are in danger, perhaps, of underestimating the work done by older surgeons if we do not hold our enthusiasm a little in check. Very excellent results were obtained by our ancestors by the ordinary excision of the hip and

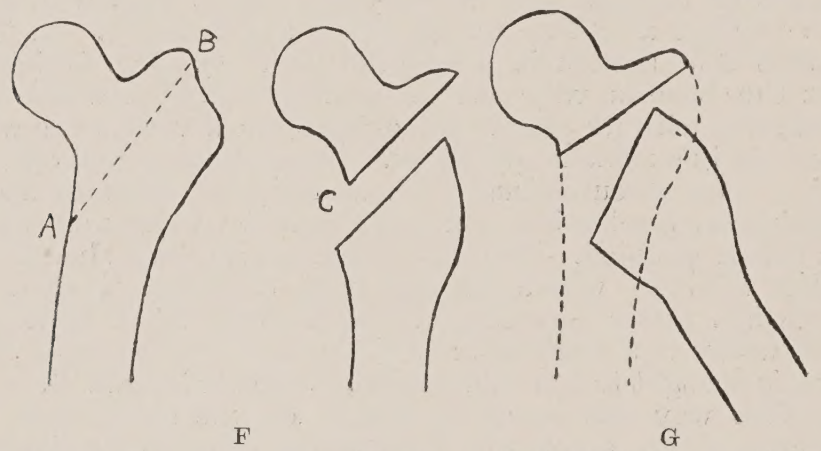

Fig. 3.—F: A, B, Line of section through trochanter; C, lengthening after traction. G, Position of fragments when limb is abducted.

elbow, and, though we hear very little of these successes now, there are vast numbers of men doing hard manual labour whose excisions have been performed without the intervention of muscle or fascial flap. There were, of course, the failures—the elbows, which did not confine their movements in normal directions, and the hips, which often ankylosed at divers angles.

The modern operation of arthroplasty requires the exposure of an ankylosed joint and the separation of the bones by manipulation and chisel at the site of the old articulation. The bones are then modelled or resected and covered with a flap of tissue either pedunculated or free, or by the interposition of some foreign body. These modern methods aim at greater precision of result and at greater stability. In my early days most of the pseudo-arthroses I performed were in cases of ankylosis of both hips, and for some years following 1895 after excising the head and neck, sometimes neck and trochanter, I covered the stump with gold-foil, and, failing that, with any material in the vicinity of the bone that came to

hand. The results on the whole were good, and when I learnt the secret of the free removal of bone, the results were consistently better.

When a difficulty arose in securing a flap, one easily got over it by thinning and gouging the compact tissue at the reversed end of the femur and hammering the sides over the medullary cavity. In this way callus exudation was prevented. Until recent years I never performed a flap operation on the elbow, but for very long I have used masses of free fat in trying to obtain mobile ankles. All over Europe and America various procedures have been advocated, but I think the honour of priority of using tissue flaps should be given to Verneuil, who as early as 1865 recommended that after removing bone for temporo-maxillary ankylosis the capsular soft parts should be inserted between the bones.

Among the most ingenious and active workers of the present day we would place J. B. Murphy. He is the great apostle, and to him undoubtedly belongs the credit of systematically attempting to restore a joint to its normal shape and function, and of drawing our attention to the value of fat and fascia as a lining to a joint because of its hygromatous transformation. As I have on other occasions pointed out, it is rare in old tuberculous conditions where bony ankylosis has resulted, to find hips which can with any success be modelled into shape. The head is usually absorbed and the neck has travelled a varying distance above the acetabulum. It is quite impossible to bring such femora, often ankylosed to the ilium, into an approximately normal position. The application of pulleys after division of the bone I know from experience to be futile.

Such cases demand the free removal of bone, as in the case of a lady of 36 upon whom I operated in 1903. Her hip was flexed and adducted, and she presented 6 in. of practical shortening. As a first stage, in order to add to the length of the limb, I performed an osteotomy and placed the limb for six weeks in abduction. Four inches of practical lengthening were gained in this way. Some months later I removed the greater part of the trochanter and neck and interposed a muscular flap. The patient now has free movement, is on her feet most of the day, and can walk many miles.

I really do not think that it makes much difference what material is used for a flap. Most tissues, whether fat or muscular, seem to turn into connective tissue, and that is exactly what is required, if we are to place reliance upon the experiments made regarding the embryology of joints and the theory of bursa formation. For this reason I use entirely free fascial flaps derived from the fascia lata—operation is thus much simplified. Some of the most successful results are those reported by Baer of Baltimore, who uses sterilized pig's bladder. From a study of the records I should lay more stress upon the cleanliness and competence of the surgeon than upon the character of the interposing flap.

The elbow-joint offers a very favourable field for arthroplasty, whether we utilize a flap from the triceps, brachialis anticus, or any of the accommodating muscles in the neighbourhood of the joint, or in the transplantation of free or pedunculated fascial flaps. I have only performed one pseudo-arthrosis of the wrist, and I then filled the space with free fat. The operation was a success, and secured permanently about 40 degrees of movement. In bony ankylosis, where the wrist is flexed and the grip consequently poor, I have often removed a wedge from the carpus in order to obtain dorsiflexion.

Undoubtedly the knee-joint is the most difficult problem in connexion with arthroplasty. In complete bony ankylosis involving patella, femur, and tibia, it is difficult to conceive a mobile joint with stability. The stability of the knee-joint is not altogether maintained by bone, but chiefly by intra-articular ligaments and capsule. If these be destroyed, as is usually the case in complete bony ankylosis, the result cannot be as satisfactory as a good firm ankylosis. Baer, who gives a very judicial presentment of his results—and he has had a large experience—tells us that of eleven cases where the ankylosis was between the three bones, five cases gave no motion, four cases gave 20 per cent., and they were of gonorrhoeal origin. Two gave useful motion, but nothing is said as to the stability of the joint. The results are very promising in cases of fibrous ankylosis where ligaments can be saved, and in those cases where the only bony fixation is between the patella and the femur. The collected results of arthroplasty of the ankylosed tuberculous knee are by no means encouraging. There is no doubt that arthroplasty has come to stay, but we should proceed warily, learning all we can from our failures and recognizing the obvious fact that so far we are only on the threshold of the subject.

May I venture to suggest that the operation is contra-indicated in the presence of disease, in the young because of the growth centres—in cases where from prolonged ankylosis and infiltration the muscles are partially destroyed, or where scar tissue surrounds the joint in such a way as to threaten the vitality of the flaps?

It is not so easy to correct the deformities of spinal caries as to avoid them, but the work of Lange, Hibbs, and Albee have added interest to this type of case. Lange of Munich introduced metal rods along the spine and stitched them in position in order to secure fixation.

A distinct advance was made by Hibbs, who utilized the spinous processes in order to bring about a bony fixation. He split each spinous process longitudinally over the area of disease, turning one half upwards and the other downwards, so that the spinous processes became ankylosed, and supplied a firm support to the column. Albee brought about the same result by transplanting a portion of tibia into the cleft of the split spinous processes (Figs. 4 and 5). Bony spinal fixation is an ideal operation in the adult, especially in the lower lumbar region, where ambulatory fixation by apparatus is impos-

sible. We have yet to solve the problem of growth of the transplant in the case of children. Will the transplanted bone grow as the child grows, and at the same rate? If not, what then? So far the reports are favourable. After

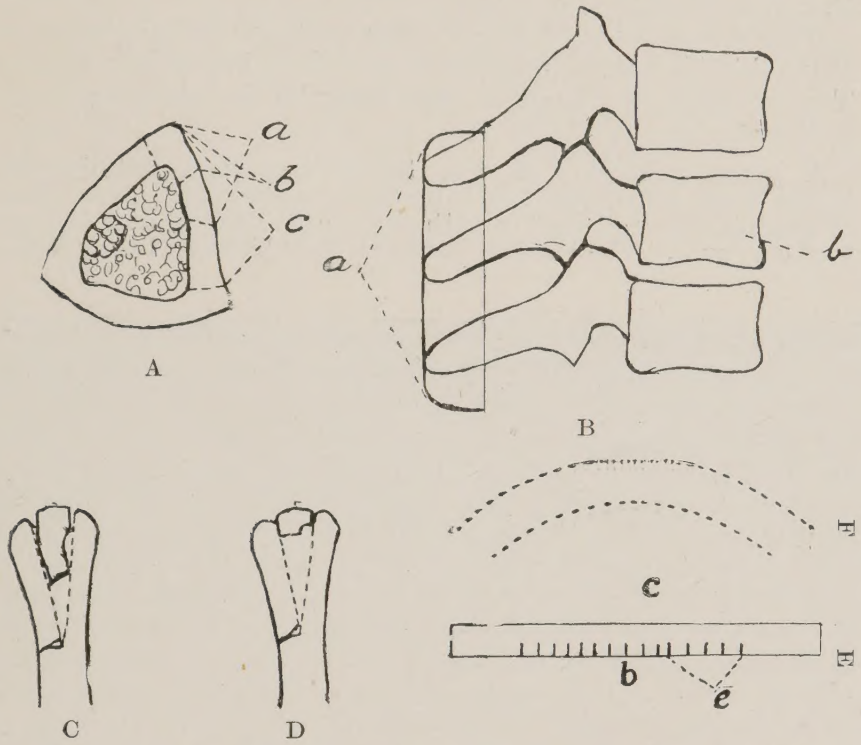

Fig. 4.—Diagram to illustrate Albee's operation of bony transplant: A, Showing methods of securing grafts from tibia. B, Showing splint-like action of transplant: *a*, Splint of bone; *b*, Diseased vertebra. C, D, Showing transplant in split spinal process. E, Showing cross incisions in graft to allow it to bend. F, Graft curved.

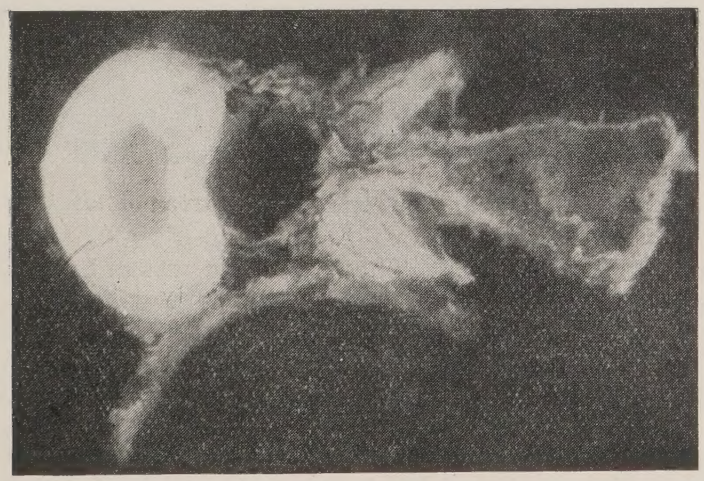

Fig. 5.—Section to show union of transplant to spinous process.

a conversation I held with Sir William Macewen I performed several operations affixing my graft against the bared laminae, and not disturbing the integrity of the spinous processes (Fig. 6).

The muscles are separated from the laminae and the base of the spinous processes, and then layers of bone are chiselled off and preserved. The transplant is laid upon the bed thus formed, and snugly covered by muscle and the preserved layers of bone.

The deformities of the rheumatoid or septic group are amenable to radical measures once the disease has ceased. The relation of such a case may be an encouragement to some.

A young woman of 30 presented two acutely flexed hips and knees and an ankle fixed by bony ankylosis. The joints stiffened five years before with very acute symptoms following typhoid fever. The left hip lay upon the abdomen bound down

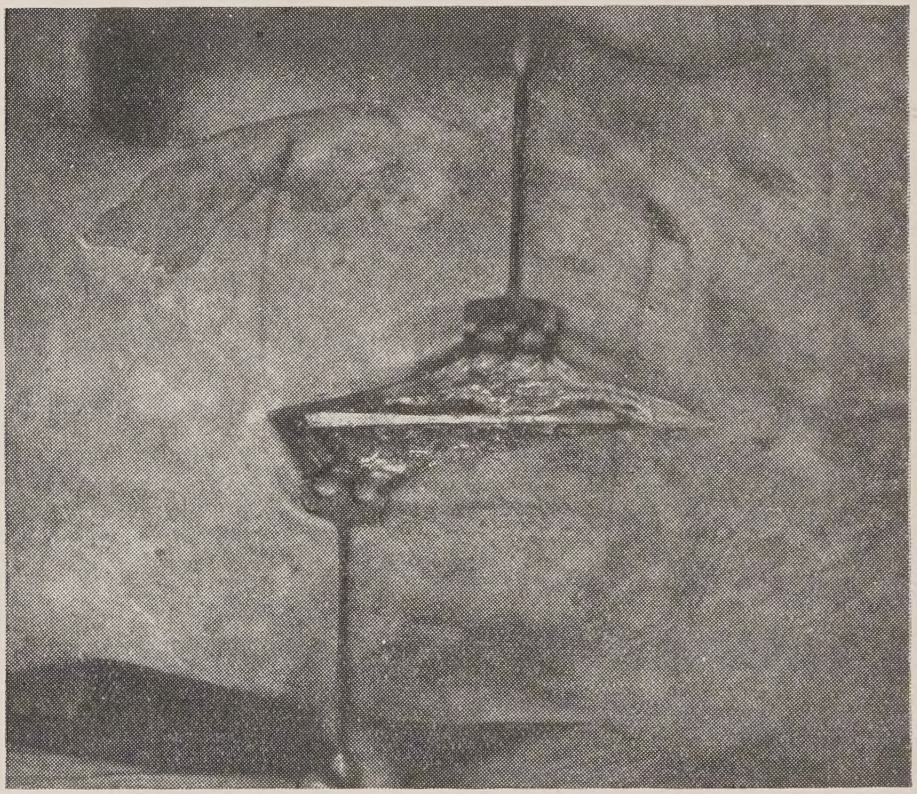

Fig. 6.—Photograph to show transplant lying on laminae.

by firm fibrous ankylosis. The right knee was ankylosed at an angle of 90 degrees, both knees were badly flexed and fixed, while the ankle looked glazed and remained synostosed in extreme equino-varus. No attempt at walking had been made. In four months I operated upon her five times. The deformity at the ankle was rectified by the removal of a large wedge. Then a wedge was removed from the left knee. Later a pseudo-arthrosis of the left hip was performed, the head and neck of the femur being removed and a muscular flap interposed. The right knee was next straightened by a similar operation as the other knee, and finally a trans-trochanteric osteotomy of the right femur. In six months the patient was walking short distances painlessly, aided only by two sticks.

Surgeons rarely enthuse at the visit of a case of so-called monarticular rheumatoid arthritis of the hip in an elderly person. I shall not deal with its early treatment. What

are we to do when a patient with this affection comes hobbling on two sticks or crutches, with a flexion deformity of 50 degrees and unendurable gnawing pain? We know that in such a case friction is the cause both of the pain and of the increase in bony excrescence. Relief from friction may be brought about in early cases by operations for the removal of bony outgrowths, such as those devised by Wheeler and Sampson Handley, or in more severe cases by bony fixation of the head of the femur to the acetabulum, as suggested by Albee, or in the still more advanced cases by the operation of pseudo-arthrosis without disarticulation, which I suggested

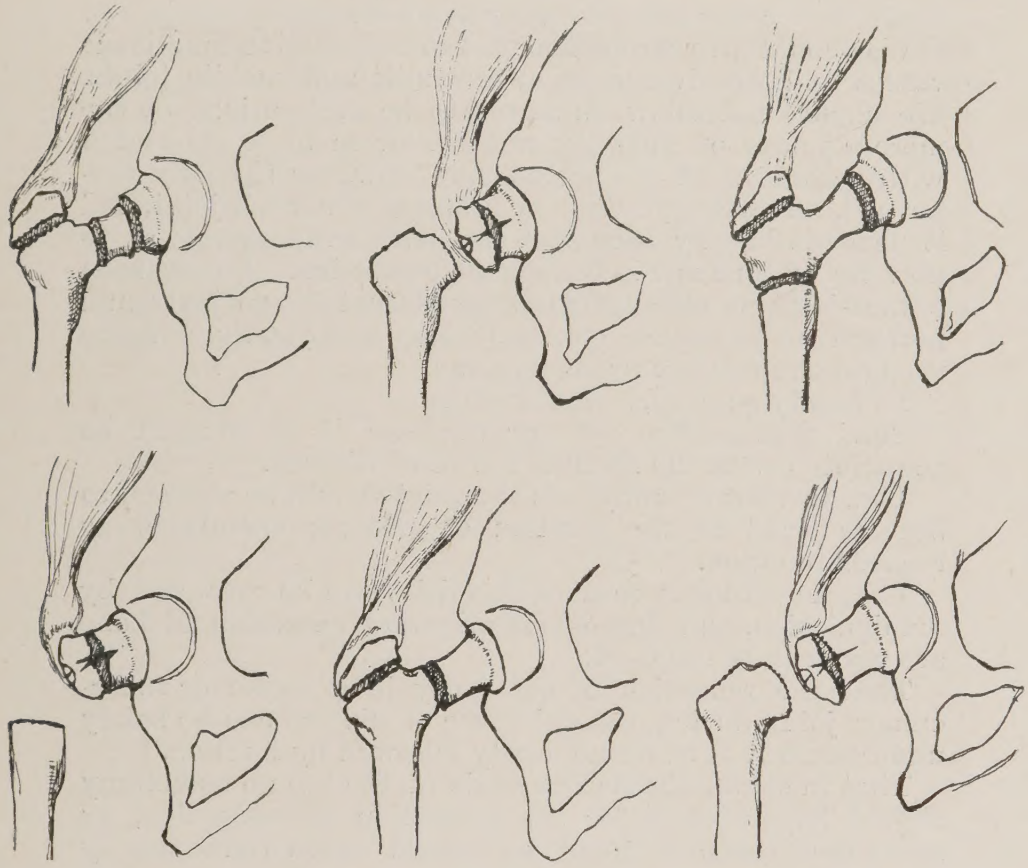

Fig. 7.—Diagram to illustrate operation of pseudarthrosis of hip.

and have practised for many years. The shock which disarticulation of the femur produces in the old is very great. I feel, therefore, that a relief from friction and a restoration of movement without the shock of disarticulation is a judicious proceeding. I devised, therefore, an operation which consisted of chiselling the trochanter from the femur and preserving it with its muscular attachments; and removing the neck of the femur and nailing the trochanter over the acetabulum, which contains the severed femoral head (Fig. 7). In this way callus exudation is avoided and movement practised without friction. This operation is rapidly done and involves but little shock.

Transplantation of joints from the cadaver has been performed on several occasions, and was first practised by Lexer. I have never had an opportunity of examining such cases after operation, and cannot give an opinion as to the results. Auto-transplantations of portions of living joints have frequently resulted in success. If time permitted one would like to dwell on some of the difficulties and dangers of operative procedures, upon the grave collapse and abdominal distension which not uncommonly follows an attempt at extending the flexed thigh of elderly folk.

I would urge, however, the importance of anticipating deformity, and of carefully choosing safe and effective methods to restore the stability and functions of the joints.

We should give careful thought to the relative functional values and disadvantages of the stiff and mobile joints. We should not allow ourselves to be mesmerized by the mere glamour of mobility, unless movement is associated with stability. It is obvious that, however skilfully performed, no arthroplasty can produce a normal joint, and it depends largely upon the surgeon's temperament as to how he estimates his canons of perfection. I have seen a knee-joint so efficiently mobilized that the patient could perform an extensive circumduction, and yet the surgeon thought the result a promising one.

To briefly sum up, I would affirm—

That deformities are preventable if a surgeon be acquainted with the natural course of disease.

That in view of ankylosis the joint should be allowed to become fixed in the position of greatest usefulness as regards function.

That in children most deformities can be corrected by manipulation, and that osteotomies and exsection of bone are very rarely required.

That the reduction of deformity in a septic or tuberculous joint during the existence of disease can be safely undertaken if it be immediately followed by fixation.

That in sound fibrous ankylosis of the hip an osteotomy should be preferred for the correction of adduction, as some recurrence of deformity would follow reduction by manipulation.

That the site of osteotomy will depend upon the nature of the ankylosis and upon the extent of the deformity. Trans-trochanteric osteotomy gives the most accurate mechanical result. It should be practised in all cases of bony fixation where the femoral neck is not absorbed and where there is no marked pathological dislocation. Where destruction of the head and neck have occurred and the femur lies close upon the pelvis, a wedge should be removed from the neighbourhood of the trochanter. In cases of fibrous ankylosis in the process of becoming sound a subtrochanteric osteotomy is indicated to prevent strain upon fibrous bands. All osteotomies require subcutaneous division of the adductors. Subtrochanteric osteotomy is contraindicated where flexion is extreme.

Arthroplasty of the hip-joint in any of its many forms may be looked upon as a valuable and successful procedure. The character of the intervening substance—whether bone, free or pedunculated fascial flap, fat, or muscle—is not so important as a good technique and a sound judgement.

It should not be performed upon children nor in the presence of active disease. It should be reserved for adult life, and has proved more successful after recovered septic than after tuberculous disease, and in the case of septic disease it should be postponed for one or more years until the periarticular structures have become more normal.

The results of arthroplasty of the knee are not too encouraging. In bony ankylosis of the femur and tibia the results are distinctly discouraging. In those instances where the ankylosis is fibrous, with perhaps bony fixation of patella, results are often good. We must recollect, however, that in such conditions mobility may often be secured without operation.

Finally, we have in painful and progressive deformities, such as in osteo-arthritis of the hip, many procedures destined to give relief by preventing the friction of tender joint surfaces.